

Ohio Operations Incident

Hannibal, OH

Environmental Sampling and Analysis Plan Version 1.4

Prepared On Behalf Of:

Statoil

Prepared By:

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1.0 INTRODUCTION AND PURPOSE

This Sampling and Analysis Plan (SAP) was prepared on behalf of Statoil supporting Incident Command to provide environmental sampling work plans related to the Ohio Operations Incident in Hannibal, OH, which began on Saturday June 28, 2014. A map of the site location is provided in Attachment A.

The incident involves a well pad that was engulfed in a fire, consuming products that were stored on-site as well as releasing produced water from a compromised wellhead. The objectives of the environmental investigation and proposed sampling include:

- 1) The collection of water, soil, and sediment samples to coarsely delineate areas of potential impact and assess the need for and, effectiveness of, the containment and cleanup activities on the well pad and areas potentially impacted from off-pad run-off.
- 2) The collection of background surface water, soil, and sediment samples to develop the range of potential background concentrations for comparative purposes and attempt to distinguish between target analytes related to this incident and non-related target analytes.

2.0 HEALTH AND SAFETY

CTEH[®] sampling personnel will review and adhere to the site specific Health and Safety Plan (HASP) developed by CTEH[®]. Sampling activities will only be completed in a safe manner and under safe conditions as dictated by the HASP.

3.0 DATA QUALITY OBJECTIVES

The data collected during field activities will be used to assess potential exposures to human health and the environment to constituents potentially related to the Ohio Operations Incident. A strategic planning approach will be employed for data collection activities providing a systematic procedure to ensure the type, quantity and quality of data used in decision-making will be appropriate for the intended application. All samples will be submitted to an analytical laboratory for a Level II data quality package.

4.0 SURFACE WATER EVALUATION AND METHODOLOGY

4.1 Surface Water Monitoring

Surrounding drainage pathways and waterways downstream of the incident location will be visually inspected and photo-documented to note adverse impacts, if any. Documentation produced will also note general conditions such as GPS coordinates, odors, water flow,

weather, observations of any dead fish, etc. General water quality readings will also be documented along waterways both up gradient and down gradient of the well pad to monitor for potentially measurable impacts. Surface water monitoring will be conducted daily and will include the following parameters:

- ☐ Temperature
- ☐ pH
- ☐ Conductivity
- ☐ Dissolved Oxygen
- ☐ Turbidity
- ☐ ORP
- ☐ Salinity
- ☐ Total Dissolved Solids

4.2 Surface Water Samples

A surface water sample was collected from run-off flowing off-site prior to the well shut-in in an effort to characterize source constituents. Containment measures have been deployed and the impacted well has been shut-in. The site is currently being monitored to determine if run-off is escaping containment or impacting local waterways; if either case is found, a sample will be collected upstream and downstream of the run-off's confluence with the potentially impacted waterway. All sampling will be documented in field notebooks, CTEH® field forms, or hand-held devices and surface water samples will be submitted to an Ohio certified lab for analysis.

Methodology and Analysis

Surface water samples will be carefully decanted directly into laboratory supplied sample containers and submitted to Pace Analytical, a NELAP-accredited laboratory, in Pittsburgh, Pennsylvania. Water quality parameters including: pH, ORP, dissolved oxygen, conductivity, salinity, TDS, temperature, and turbidity will be recorded for each surface water sample using a Horiba U-52 (or similar) water quality meter.

CTEH® plans on submitting collected samples for analysis of:

- ☐ Volatile organic compounds (VOCs) + TICS by USEPA Method 8260
- ☐ Semi-volatile organic compounds (SVOCs) + TICS by USEPA Method 8270
- ☐ Total Petroleum Hydrocarbons – Diesel Range Organics by USEPA Method 8015
- ☐ Cations by USEPA Method 6010B
- ☐ Anions by USEPA Method SM4500
- ☐ Ethylene Glycol by USEPA Method 8015

Acute aquatic toxicity tests indicate an LC₅₀ for tributyl tetradecyl phosphonium chloride (TTPC) of <1 mg/L in certain fish species. At this time, no USEPA Method exists for the analysis of TTPC,

a compound which comprises up to 10% (w/w) of the biocide BE-9 present on-site. Efforts are currently being undertaken to explore the potential for analytical method development for TTPC and, if available, will be presented to the Environmental Unit Leader for discussion.

Location and Frequency

Initial sampling consisted of the collection of surface water samples from the potentially impacted run-off liquids flowing off of the incident site. In addition to single-event surface water samples, i.e. locations sampled at one point in time only (site run-off and/or feeding tributaries), additional samples will be collected daily from established surface water sampling locations. A table identifying the frequency of sampling at each station, along with a map identifying the location of each station is provided in Attachment 1. Surface water sampling will continue until Unified Command deems further daily sampling unnecessary following assessment of analytical sampling results.

Additional daily surface water sampling may consist of additional samples collected from the following locations as deemed necessary by Unified Command:

- ☐ Within the confluence of the Ohio River and Opossum Creek.
- ☐ Within the Ohio River, immediately upstream of the confluence of the Ohio River and Opossum Creek.
- ☐ Within the Ohio River, immediately downstream of the confluence of the Ohio River and Opossum Creek.
- ☐ Within the Ohio River along the West Virginia shoreline, directly across from the confluence of the Ohio River and Opossum Creek.

Surface water samples will be collected for 7 days following the start of the incident, at which point laboratory data will be reviewed and sampling plans will be re-assessed.

5.0 SOIL AND SEDIMENT SAMPLING METHODOLOGY AND ANALYSIS

5.1 On-Site Soil Samples

Soil samples will be collected from the production pad area in order to characterize the surface soil for potential off-site disposal, utilizing the Toxicity Characterization Leaching Procedure – TCLP.

Methodology and Analysis

The following procedures will be implemented for soil sampling in the designated areas on-site. The planned sample locations are indicated on the map attached as Attachment A. Soil samples will be collected from the ground surface.

1. Soil samples from each location will be collected utilizing a stainless steel spoon. Each sample container will be completely filled to minimize headspace. Vegetation, rocks, litter, and other non-native soil material will be carefully removed.
2. Non-disposable equipment will be decontaminated using a bristled brush and a solution comprised of a laboratory grade, non-phosphate detergent (e.g., Alconox or Liquinox), rinsed with distilled water, and then rinsed a second time with deionized water.
3. The following field notes will be collected for each soil sample:
 - a. Observations regarding color, odor, etc.
 - b. GPS coordinates of sampling points
 - c. Photo-documentation of sample area
 - d. Date and time
4. Sample containers will be clearly labeled with the following information:
 - a. Unique sample identification
 - b. Sampler initials
 - c. Date and time sample collected
5. Field samples will be contained in accordance with appropriate USEPA specifications consistent with the intended analysis.
6. Evidence of collection, shipment, laboratory receipt, and laboratory custody will be documented by maintaining a chain of custody (COC) that records each sample and the individuals responsible for sample collection. All samples will be accompanied by a COC Record.

CTEH® plans on submitting collected samples for analysis of:

- ☐ TCLP volatile organic compounds (VOCs) by USEPA Method 8260
- ☐ TCLP semi-volatile organic compounds by USEPA Method 8270
- ☐ TCLP metals USEPA Method 200.7
- ☐ Reactivity, Corrosivity and Ignitability (RCI)
- ☐ Total Petroleum Hydrocarbons – Diesel Range Organics by USEPA Method 8015

Location and Frequency

Initial soil samples will be collected from the production pad area once the area has been cleared by IC for sampling activities. Additional samples may be required once data has been received and reviewed by IC.

5.2 Off-Site Soil and Sediment Samples

Off-site soil and sediment samples will be collected from preferential run-off pathways from the production pad and select stream sampling locations in conjunction with surface water sampling locations.

Methodology and Analysis

The following procedures will be implemented for off-site soil and sediment sampling in the designated areas. Off-site soil samples will be collected from preferential run-off pathways from the production pad and will be initiated after a near-pad survey has been conducted. Sediment samples will be collected in conjunction with daily surface water sampling locations as described in Section 4.0, above.

1. Sediment samples from each location will be collected utilizing a stainless steel spoon, or a modified Van Veen-type, self-tripping ponar sampling device (ponar). The overlaying water in the spoon or ponar sampling device will be carefully decanted off. Each sample container will be completely filled to minimize headspace. Vegetation, rocks, litter, and other non-native soil material will be carefully removed.
2. Soil samples from each location will be collected utilizing a stainless steel spoon. Each sample container will be completely filled to minimize headspace. Vegetation, rocks, litter, and other non-native soil material will be carefully removed.
3. Non-disposable equipment will be decontaminated using a bristled brush and a solution comprised of a laboratory grade, non-phosphate detergent (e.g., Alconox or Liquinox), rinsed with distilled water, and then rinsed a second time with deionized water.
4. The following field notes will be collected for each soil sample:
 - a. Observations regarding color, odor, etc.
 - b. GPS coordinates of sampling points
 - c. Photo-documentation of sample area
 - d. Date and time
5. Sample containers will be clearly labeled with the following information:
 - e. Unique sample identification
 - f. Sampler initials
 - g. Date and time sample collected
6. Field samples will be contained in accordance with appropriate USEPA specifications consistent with the intended analysis.
7. Evidence of collection, shipment, laboratory receipt, and laboratory custody will be documented by maintaining a chain of custody (COC) that records each sample and the individuals responsible for sample collection. All samples will be accompanied by a COC Record.

CTEH® plans on submitting collected samples for analysis of:

- ☐ Volatile organic compounds (VOCs) + TICS by USEPA Method 8260
- ☐ Semi-volatile organic compounds (SVOCs) + TICS by USEPA Method 8270
- ☐ Total Petroleum Hydrocarbons – Diesel Range Organics by USEPA Method 8015

- ☐ Chlorides
- ☐ Cations by USEPA Method 6010B
- ☐ Anions by USEPA Method SM4500
- ☐ Ethylene Glycol by USEPA Method 8015

Similar to the surface water sampling, efforts will be made to identify analytical methods to quantify the concentration of TTCP in off-site soil.

Location and Frequency

Initial sediment samples will be collected from the preferential run-off pathways from the production pad area and at designated stream locations. Additional samples may be required once data have been received and reviewed by IC.

5.3 Sub-surface Soil Sampling

Sub-surface soil samples will be collected from potentially impacted areas both on and off the StatOil Eisenbarth well pad. Samples will be collected through hand advanced direct push soil borings.

Methodology and Analysis

The following procedures will be implemented for on-pad and off-pad soil in the designated areas. Soil samples will be collected from potential preferential run-off pathways from the production pad or based on surface water flow direction and will be initiated after a near-pad survey has been conducted. Subsurface soil samples will be collected from locations depicted on the Soil Sampling Location map in Attachment A.

Utility Clearance

Prior to field mobilization for the activities described in this SAP, a utility mark-out will be performed to identify underground utilities at the Site. The utility mark-out will be made through the Ohio Utilities Protection Service (OUPS) – underground utilities search system at 8-1-1 or (800) 362-2764. In addition to the OUPS call, a review of available site drawings will be conducted to evaluate for the presence of site utilities not identified by the OUPS notification. If necessary, soil boring locations will be modified in the field to avoid potential interference from utilities.

Soil Boring Installation

Subsurface soil samples will be collected through the use of direct push Geoprobe System's - Large Bore soil sample barrel. These borings will be driven into the ground using an electric jackhammer outfitted with the direct push equipment.

Soil borings will be advanced to the depth of equipment refusal or approximately 10', whichever is less.

Field work conducted during this investigation, including soil boring and sampling activities will be conducted in accordance with the Job Safety Analysis (JSA) and Work Permit.

Continuous soil cores will be collected within disposable acetate sleeves with the direct push equipment. Upon retrieval from the boring, the sleeves will be opened by the CTEH personnel for field screening and sample collection.

Following completion of borings at a given location, including field screening and sampling activities, soil not used for sampling will be returned to the boring. Some borings may be left open and PVC well screen may be temporarily placed in the boring to keep the bore hole open to look for subsurface water infiltration.

Sample Collection

1. Soil samples from each location will be collected utilizing a stainless steel spoon or dedicated disposable sampling equipment. Each sample container will be completely filled to minimize headspace. Vegetation, rocks, litter, and other non-native soil material will be carefully removed.
2. Non-disposable equipment will be decontaminated using a bristled brush and a solution comprised of a laboratory grade, non-phosphate detergent (e.g., Alconox or Liquinox), rinsed with distilled water, and then rinsed a second time with deionized water.
3. The following field notes will be collected for each soil sample:
 - A. Observations regarding color, odor, PID readings, etc.
 - B. Soil lithology and depth
 - C. GPS coordinates of sampling points
 - D. Photo-documentation of sample area
 - E. Date and time
4. Sample containers will be clearly labeled with the following information:
 - h. Unique sample identification
 - i. Sampler initials
 - j. Date and time sample collected
5. Field samples will be contained in accordance with appropriate USEPA specifications consistent with the intended analysis.
6. Evidence of collection, shipment, laboratory receipt, and laboratory custody will be documented by maintaining a chain of custody (COC) that records each sample and the individuals responsible for sample collection. All samples will be accompanied by a COC Record.

CTEH® plans on submitting collected samples for analysis of:

- ☐ Volatile organic compounds (VOCs) + TICS by USEPA Method 8260
- ☐ Semi-volatile organic compounds (SVOCs) + TICS by USEPA Method 8270
- ☐ Total Petroleum Hydrocarbons – Diesel Range Organics by USEPA Method 8015
- ☐ Chlorides
- ☐ Cations by USEPA Method 6010B
- ☐ Anions by USEPA Method SM4500

- Ethylene Glycol by USEPA Method 8015

Similar to the surface water sampling, efforts will be made to identify analytical methods to quantify the concentration of TTCP in off-site soil.

Location and Frequency

Initial subsurface soil samples will be collected from the preferential run-off pathways or surface water runoff areas from the production pad area. Additional samples may be required based on field observations and/or once data have been received and reviewed by IC.

Upon completion of the borings, if any water or soil is found to be suspect, samples may be collected for analyses. Water and soil samples will be collected in accordance with Sections 4.0 and 5.2 above.

5.4 Soil Test Pits

In order to investigate any potential subsurface water or liquid migration from the production pad, test pits will be installed at various locations off the pad. The test pits will be installed through the use of a hydraulic mini-excavator. The test pits will be excavations to a depth of approximately 3'-4' and a length of approximately 4' and a width of approximately 2'. The pits will be left open to monitor for any water or liquid infiltration for purposes of evaluating potential subsurface migration.

Upon completion of the test pits, if any water or soil is found to be suspect, samples may be collected for analyses. Water and soil samples will be collected in accordance with Sections 4.0 and 5.2 above.

If warranted, the test pits may be extend and turned into trenches for recovery of water or liquids from either surface or sub-surface flow.

6.0 SAMPLE HANDLING PROCEDURES

Samples will be placed in laboratory supplied sample containers and labeled with a sample identification number, sample depth (for water column sampling), sampler name, sample date, analysis and methodology requested, and time of sample collection, and immediately placed in a cooler on ice pending laboratory analysis. Samples will be packaged, labeled, retained on ice, and documented in an area which is free of impact and provides for secure storage. Custody seals will be placed on each sample-containing cooler, and chain-of-custody procedures will be maintained from the time of sample collection until arrival at the laboratory to protect sample integrity. Shipping or transporting of samples to the laboratory will be done within a timeframe such that recommended holding times are met. Samples are being collected in adequate volumes in sample containers of a broad variety to ensure that any future requested analyses can be performed given the collected sample container types.

6.1 SAMPLE LABELING

Sample containers will be clearly labeled with the following information:

- ☐ Unique sample identification;
- ☐ Sample Type (discrete or composite, sediment and/or soil samples only);
- ☐ Sampler name or initials;
- ☐ Date sample collected;
- ☐ Time sample collected; and
- ☐ Analysis to be performed.

The unique sample designation will include the following: sample type, two digit day, two digit month, two letter matrix prefix, three-digit numerical designation, and QA sample designation, as appropriate. The sample type will be SW surface water and SC for source sampling.

Quality assurance samples include Matrix Spikes (MS - 1 in 20 by media), Matrix Spike Duplicates (MSD - 1 in 20 by media), rinsate blank (RB) only when using non-dedicated sampling equipment, and duplicates (DUP) in 1 out of 10 samples by media. These samples are defined further below.

7.0 QUALITY ASSURANCE

Sampling will be carried out in conjunction with a well-defined quality assurance (QA) program. The goal of the field QA program is to document that samples are collected without the effects of accidental cross- or systematic contamination and refers to the sampling, analysis, and data validation procedures for generating valid and defensible data. To provide QA for the proposed sampling event, the following sampling, analysis, and data validation procedures will be performed:

Field Calibration

Instruments used in the field as part of this sampling event are anticipated to consist of Horiba U-52 water quality meters, GPS units, digital cameras, and hand-held data collection devices such as tablets/smart phones. Horibas will be calibrated daily. Other equipment is not anticipated to require field calibration. Operators of each piece of equipment are responsible for maintaining (including proper battery charge) and operating this equipment such that it conforms to each respective manufacturer's specifications.

Field Duplicate Sample

For approximately every ten samples collected in the field, one field duplicate will be collected and submitted for laboratory analysis to verify the reproducibility of the sampling methods. Field duplicates will be prepared by separately submitting an aliquot from the same sample location to the laboratory for analysis consistent with the proscribed analyses.

Field Split Samples

Field split samples refer to samples collected by the on-site regulatory agency or its designee from the same sampling location and independently submitted to a different laboratory for analysis. Field split samples may be collected at the discretion of representatives of the regulatory agency or Incident Command.

Laboratory QA

Laboratory quality control procedures will be conducted in a manner consistent with relevant state and federal regulatory guidance. Deliverables will contain the supporting documentation necessary for data validation. Internal laboratory quality control checks will include method blanks, matrix spikes (and matrix spike duplicates), surrogate samples, calibration standards, and laboratory control standards (LCSs).

Matrix Spike/Matrix Spike Duplicate Sample

Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples refer to field samples spiked with the analytes of interest prior to being analyzed at the laboratory to gauge the quality of analysis. Approximately one in twenty samples will be analyzed as MS/MSD samples.

Data Validation

Validation of the data generated by the laboratory performing the analyses will include at a minimum sample holding times, accuracy, precision, contamination of field generated or laboratory method blanks, and surrogate compound recovery. Accuracy will be determined by evaluating LCS and MS recovery. Precision will be determined by evaluating laboratory and field duplicate samples. Level II data validation will be performed on 100% of submitted samples. Level IV data validation will be performed on at least 10% of submitted samples.

8.0 DECONTAMINATION PROCEDURES

Decontamination procedures refer to the steps undertaken to minimize the potential for off-site contamination and cross-contamination between individual sampling locations. Prior to collecting any sample for this investigation, the following decontamination procedures will be undertaken: non-disposable sampling equipment such as Kemmerer water sampling devices which come into contact with sampling media will be decontaminated using a bristled brush and a solution comprised of a laboratory grade, non-phosphate detergent (e.g., Alconox or Liquinox) and deionized water. Depending on ancillary activities being conducted for the response to this release, the decontamination of sampling equipment will be conducted over poly sheeting at the sample location or in a nearby designated area. The sampling equipment to be decontaminated will first be placed in a bucket containing the detergent solution and thoroughly washed using a bristled brush. The items will then be transferred to the second 5-gallon bucket containing deionized water for rinsing. Following the initial rinsing, the item will be held over the third 5-

gallon bucket while deionized water is carefully decanted over each item. Decontaminated items will be wrapped in clean aluminum foil for transit to the next sampling location.

Nitrile gloves will be worn by sampling personnel and changed between activities at each discrete sample collection location. Previously worn nitrile gloves will be discarded in appropriate waste receptacles with other PPE.

9.0 WASTE DISPOSAL

The method for storage and disposal of investigative-derived waste materials will comply with applicable local, state, and federal regulations in a manner consistent with the Waste Management Plan.

10.0 DATA ANALYSIS

To assess the potential environmental impact from the compromised well pad, the results of sampling will be reviewed for the presence/absence of on-site constituents. The concentrations of detected compounds will then be compared to appropriate regulatory standards. The results of laboratory analyses will be provided to IC.

11.0 RECORDS MANAGEMENT

Records management refers to the procedures for generating, controlling, and archiving project-specific records and records of field activities. Project records, particularly those that are anticipated to be used as evidentiary data, directly support current or ongoing technical studies and activities, and provide historical evidence needed for later reviews and analyses, will be legible, identifiable, retrievable and protected against damage, deterioration, or loss on a centralized electronic database. Handwritten records will be written in indelible ink. Records will likely include, but are not limited to, the following: bound field notebooks on pre-numbered pages, sample collection forms, personnel qualification and training forms, sample location maps, equipment maintenance and calibration forms, chain-of custody forms, maps and drawings, transportation and disposal documents, reports issued as a result of the work, procedures used, correspondences, and any deviations from the procedural records. Documentation errors will be corrected by drawing a single line through the error so it remains legible and will be initialed by the responsible individual, along with the date of change, and the correction will be written adjacent to the error.

Attachment A:

**Frequency of Sampling Table
&
Analytical Sampling Map**

Sample Location	Sampling Frequency
SW01	1x
SW02	1x
SW03	Daily
SW04	Daily
PW05	1x
SW06	Daily
SW07	Daily
SW08	Daily
SW09	Daily
SW10	Daily
SW11	1x
SW12	1x
SW13	1x
SW14	1x
SW15	1x
SW16	Daily
SW17	Daily
SW18	Daily
SW19	Daily
SW20	Daily
SW21	Daily



Legend

Proposed Sample Locations

- Soil Characterization
- Surface Soil Sample
- ▲ Test Pit

